PB86-155611

Inspection and Maintenance of New Technology Vehicles in Washington, D.C

(U.S.) Environmental Protection Agency
Ann Arbor, MI

Jul 85

U.S. Department of Commerce
National Technical Information Service
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TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-AA-TSS-85-07		PB86 155611 7AS

4. TITLE AND SUBTITLE	5. REPORT DATE
Inspection and Maintenance of New Technology Vehicles In Washington, D.C.	July 1985
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Jonathan Adler	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
U.S. Environmental Protection Agency Office of Mobile Sources Technical Support Staff Ann Arbor, MI 48105	11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED Technical
	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This report presents the results of an emission testing program which was conducted for EPA in Washington, D.C., under contract.

In the test program, 1980 and 1981 model year vehicles which failed the Inspection and Maintenance (I/M) test in Washington, D.C. were given two or three series of emissions tests. Each series included a Federal Test Procedure (FTP), a Highway Fuel Economy Test, and the following short tests: 50 mph cruise, four-mode idle, engine restart idle, and loaded two-mode. In June, 1984, EPA became aware of some qulaity control problems which were evident at the D.C. inspection stations. These problems may have caused some of the vehicles which were participating in this project to be inappropriately failed during the initial inspection or inappropriately passed during the reinspection. Analyses described in the report evaluate the decisions made by the inspcetion lane, and compare the effects of I/M on the whole group of cars with those of subgroups that have had suspect cases removed.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Exhaust Emissions Motor Vehicles Hydrocarbons Carbon Monoxide Nitrogen Oxides	Emission Control Technology Inspection Maintenance Federal Test Procedure Highway Fuel Economy Test	

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report)	21. NO. OF PAGES
Release Unlimited	unclassified	36
	20. SECURITY CLASS (This page)	22. PRICE
	unclassified	

EPA Form 2220-1 (9-73)

PB86-155611

EPA-AA-TSS-85-07

Technical Report

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U. S. Environmental Protection Agency

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NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

INSPECTION AND MAINTENANCE ON NEW TECHNOLOGY VEHICLES IN WASHINGTON, D.C.

1.0 Introduction

In 1978 and 1979, EPA conducted an emissions test program in Portland, Oregon. The Portland Study provided data which have been useful in the development of mobile source models and public policy regarding inspection and maintenance (I/M) programs. Among these data is information about the emissions behavior of a fleet influenced by I/M, the costs and effectiveness of emission-related repairs, and how well I/M short tests can identify excess emissions. Since the completion of the Portland Study, many changes have occurred in the emission control technology of cars. The new technology alters the way cars perform on the short tests of I/M programs, respond to repairs, and behave in a fleet. Since the changes have included the addition of complex electronic controls, questions have arisen about whether most mechanics can conduct effective repairs on these vehicles.

EPA desired to have information about new technology cars which would be comparable to the information gained in the Portland Study, subject to more restricted resources. EPA initiated a test program in Washington, D.C. to analyze how new technology vehicles respond to I/M. Washington was chosen as the sample site because testing facilities were already available, because the I/M program there does not allow cost waivers (which would introduce recruiting and data analysis complications), and because its centralized format made recruiting easier. The program was conducted by the testing firm of EG&G Automotive Research (EG&G) under EPA contract number 68-03-3202 during the spring and summer of 1984. The contractor completed testing on seventy-eight light-duty vehicles. Twenty-four vehicles were of the 1980 model year, and fifty-four were of the 1981 model year.

In this program, new technology vehicles which failed the I/M test in D.C. were given two or three series of emissions tests, each including a Federal Test Procedure (FTP), a Highway Fuel Economy Test, and the following short tests: 50 mph cruise, four-mode idle, engine restart idle, and loaded two-mode idle. Each test series also included an examination and diagnosis by an in-house mechanic. The seventy-eight cars were recruited for EG&G testing after they failed the initial I/M test at a District-operated test lane. The first series of EG&G tests provided information about the condition of the vehicles as they failed. After the first test, the vehicles were returned to their owners, who then completed the I/M

process. The cars were brought back to the test facility after they had been repaired and passed District or District-licensed reinspection. Each received a second test series. The difference between the emission results in the first and second series shows the amount of emission reduction achieved for these vehicles by the repairs. As part of his second examination, the contractor's mechanic described the repairs which appeared to have been done, and those which were reported by the owner. Most of the vehicles were then released from the program, but twenty-two were retained for further repairs, which were conducted by the contractor's mechanic. Originally, the contractor was to have chosen vehicles which had high emissions (at least twice the FTP standard for one or more pollutant) during the second test to receive these repairs. In retrospect, it appears that this criterion was not followed in all cases. All of the cars chosen for contractor repairs had emission-related malfunctions during the second test sequence, but not all had high FTP emissions. After the contractor's repairs, these vehicles were tested a third time.

In June, 1984, EPA became aware of some quality control problems being experienced at the D.C. inspection stations. Because of these problems, EPA became concerned that some of the vehicles being tested by the contractor may have been inappropriately failed at their initial D.C. inspection and others may have been inappropriately passed upon reinspection. In order to allow the results of this study to be applicable to I/M programs without these problems, some vehicles should be removed from the analysis. Data analysis techniques which accomplish this removal are discussed in the next section.

2.0 Data Preparation

The results of this project will show approximately the emission reductions that were achieved from these vehicles by the I/M program in Washington, D.C. during the spring and summer of 1984. At that time, the program was experiencing some quality assurance (QA) problems. Because of these problems, some decisions which were made by the inspection stations during the inspections and reinspections may have been incorrect. Such decisions affect the emissions reductions achieved by the I/M program; they also affect the results of this study. In order to estimate the results of an I/M program without these QA problems, cases in which these decisions were incorrect should be removed from the analysis. While this study cannot compensate for cases in which vehicles incorrectly passed the initial inspection (they are not part of the study), cases in which vehicles incorrectly fail the inspection or pass the reinspection may be evaluated. It would be impossible to re-create the condition of each car at the inspection station

at either the initial or the post-repair I/M test, but the car's actual performance there may be inferred from the results of the four idle-neutral segments among the short tests which were conducted by the contractor. Emission readings of the D.C. inspection are taken during the idle-neutral mode.

During the second (post-repair) test sequence, sixteen vehicles failed at least one of the contractor's idle tests at the 1.5% CO and 300 ppm HC cutpoints used in D.C. They and their scores are listed in Appendix E. Eight of the sixteen failed decisively in all four segments, with all CO readings over 3.0% or all HC readings over 350 ppm. These vehicles (numbers 002, 004, 042, 049, 126, 127, 133, and 231) probably should not have passed the reinspection, based on their consistently high idle scores. Vehicle 231 received subsequent repairs by the contractor which reduced its idle emissions below the cutpoints, so it receives special note in the results section. The results section of this report includes analyses of the data both with these vehicles included and with them removed. The other eight may have legitimately passed the reinspection, because each came close to passing at least one of the contractor's idle tests. They are not treated separately from the rest of the data.

There were also several cars which probably should not have failed their initial inspections. Vehicle 24, for example, had FTP scores of 0.11 g/mi of HC and 1.09 g/mi of CO and idle test scores of 0.2% CO and 20 ppm HC during the first contractor test sequence. However, there is no clear distinction in the data between cars that should not have failed the D.C. test and cars that could have properly failed.

This lack of a distinctly clean group of cars dictates that one can only arbitrarily define a criterion for whether a vehicle correctly failed the initial D.C. inspection. "Screening" based on the contractor's idle test results is an attempt to apply such a criterion. It assumes that a car which has consistently low idle scores at the laboratory probably should have had low scores at the D.C. lanes. By applying conservative cutpoints to all four idle segments it may be possible to identify and remove falsely failed cars. Screening extrapolates a low idle score from four other low idle scores. There are several cases in the data where three of the four known idle scores are low (much less than the I/M cutpoints) and the fourth is high (exceeding the cutpoints). It is also possible that all four idle tests at the lab could be low and the D.C. inspection score legitimately high due to an intermittent problem. Despite this shortcoming, screening is the best available method to identify cases of vehicles which should not have failed the initial inspection or participated in this testing program.

The data from this project were analyzed with combinations of the following conditions applied:

- The eight vehicles which clearly should not have passed reinspection are excluded. This determination is based on idle scores above 3.0% CO or 350 ppm HC in all four idle-neutral segments of the second test sequence. By comparing results with and without this condition, the importance of proper reinspection becomes clear.

- Vehicles are excluded which have low emissions in all four idle segments of the initial test sequence. Conservative screening cutpoints of 0.3% CO and 60 ppm HC were chosen because higher cutpoints further reduce the sample size, and lower readings approach the tolerance limits of the measurement system.

These conditions are intended to remove from analysis vehicles which appear to have received incorrect inspections or reinspections. However, they may, when applied, introduce sampling bias to the results. It is not possible to determine the exact effects of this bias.

The results include average emissions for the first and second tests, and average emissions of the vehicles as they left the program (the third test, when performed, otherwise the second.)

3.0 Results

Commercial maintenance reduced avarage emissions of HC and CO and raised emissions of NOx from the test fleet. Maintenance by the contractor further reduced emissions of HC and CO. The contractor was also able to reduce NOx to a level below that of the as-received fleet. Fuel economy improved slightly on average with maintenance, but there was considerable variation among vehicles.

Tables 1 through 6 summarize the average FTP scores of groups of vehicles in this program. Results are separated by model year. Within the 1980 model year, the results of General Motors (GM) vehicles and non-GM vehicles are separated because of the sealed carburetor technology which only GM applied in that year. This separation is not useful among vehicles which received repairs at the laboratory (Table 2), as only three 1980 cars received such repairs. When reviewing the tables, the reader should consider the following notes.

The values listed depend heavily on the performance of a small group of the vehicles in the sample. The results are

average values, and a single vehicle which has very high emissions will influence them considerably. A few of the cars have emissions which are high enough to classify them in EPA terms as "super emitters" (at least 12 g/mi HC or 180 g/mi CO). In some of the smaller samples, large changes in the average emissions could be caused by the influence of one such vehicle. Note the difference between Tables 5 and 6 in the "changes 1-2" result for the 1981 vehicles. The difference between the samples represented in these tables is attributable to one vehicle, #231.

The additional reductions which were achieved by the contractor's repairs were affected by the following factors:

- The mechanic is competent and especially well-versed in emission control. He also had the use of the vehicles' FTP scores as a diagnostic indicator.

- Vehicles were often chosen for this maintenance because they had problems, evident from the mechanic's observations, for which the repairs would reduce emissions.

- The goal of the mechanic was to reduce the vehicles' emissions during the FTP.

- The reductions may have been limited by the fact that the test contract did not allow the contractor to repair all of the cars, and that some repairs were omitted in order to isolate the effects of others.

Table 1 lists the average emissions for all vehicles in each category of the sample. The values listed for "test 1" and "test 2" are the average emissions during the initial ("as received") test and the second (after commercial repair) test. The "final" values are the average emissions of the vehicles as they left this testing program; i.e., the results of the third (after contractor maintenance) test in cases where such tests were done, and the results of the second test in the other cases. The values listed for "change 1-2" are the percentages by which emissions changed as a result of commercial maintenance (i.e., the change from test 1 to test 2). The net change values show the percentage difference between the emissions of the vehicles as received and those of the vehicles as they left the program.

Table 1
Average FTP Scores, All Vehicles

Model Year	N		HC (g/mi)	CO (g/mi)	NOx (g/mi)	Fuel Economy (mi/gal)
81	54	Test 1	1.70	30.71	1.12	19.79*
		Test 2	1.22	22.28	1.19	19.96
		Change 1-2	-28%	-27%	+ 6%	+ 1%
		Final	1.01	17.08	1.07	20.23
		Net Change	-41%	-44%	- 4%	+ 2%
80	24	Test 1	1.59	27.57	1.90	19.63
		Test 2	1.25	19.53	2.03	19.60
		Change 1-2	-21%	-29%	+ 7%	0%
		Final	1.19	18.85	1.83	19.59
		Net Change	-25%	-32%	- 4%	0%
80 GM only	10	Test 1	1.80	30.43	2.22	16.23
		Test 2	1.43	17.04	2.51	16.38
		Change 1-2	-21%	-44%	+13%	+ 1%
		Final	1.33	15.24	2.10	16.39
		Net Change	-26%	-50%	- 5%	+ 1%
80 Non-GM	14	Test 1	1.43	25.53	1.67	23.09
		Test 2	1.12	21.31	1.68	22.78
		Change 1-2	-22%	-17%	+ 1%	- 1%
		Final	1.10	21.42	1.63	22.75
		Net Change	-23%	-16%	- 2%	- 1%

* Average fuel economy represents the harmonic mean of individual fuel economies; the inverse of the mean of the inverses of the individual values.

The scores listed in Table 1 for the first and second tests should approximate those of same model year vehicles which failed the inspection and were repaired in the Washington, D.C. I/M program during the spring and summer of 1984. The emission reductions shown between the two tests are probably close to the actual reductions which the program achieved at that time.

Table 2 shows the average emissions of the vehicles which received contractor repairs. The contractor was more successful at reducing emissions than the commercial repair facilities. It should be noted that the contractor tended to repair those vehicles which had evident problems even after the commercial repairs.

Table 2
Average FTP Scores of Vehicles
Receiving Contractor Maintenance

Model Year	N		HC (g/mi)	CO (g/mi)	NOx (g/mi)	Fuel Economy (mi/gal)
81	19	Test 1	2.01	36.02	1.43	17.74
		Test 2	1.86	36.74	1.55	17.55
		Change 1-2	- 7%	+ 2%	+ 8%	- 1%
		Final	1.26	21.98	1.19	18.16
		Net Change	-37%	-39%	-17%	+ 2%
80	3	Test 1	2.39	51.64	2.64	18.78
		Test 2	1.52	26.25	3.71	19.49
		Change 1-2	-36%	-49%	+41%	+ 4%
		Final	1.06	20.77	2.11	19.42
		Net Change	-56%	-60%	-20%	+ 3%

Table 3 shows the emission values and reductions for the vehicles which were correctly failed in the initial inspection of the I/M program (as predicted by the screening technique described earlier). A comparison of these results with those in Table 1 shows the importance of quality assurance during the initial inspection. The increased reduction figures from the correctly failed vehicles are a result of their higher average emissions during the initial test. The total reduction from this group is roughly the same as that of the whole sample, because these are the vehicles from which the reductions may be obtained. Repairs of the falsely failed vehicles which are excluded from this group yield little benefit, as their already low emissions are difficult to reduce further.

Table 3
Average FTP Scores, Correct Failures

Model Year	N		HC (g/mi)	CO (g/mi)	NOx (g/mi)	Fuel Economy (mi/gal)
81	40	Test 1	2.10	38.82	1.15	18.67
		Test 2	1.24	21.20	1.29	19.28
		Change 1-2	-41%	-45%	+12%	+ 3%
		Final	1.16	18.91	1.10	19.48
		Net Change	-45%	-51%	- 4%	+ 4%
80	21	Test 1	1.69	30.17	1.88	19.34
		Test 2	1.26	20.47	2.03	19.38
		Change 1-2	-25%	-32%	+ 8%	0%
		Final	1.20	19.69	1.80	19.37
		Net Change	-29%	-35%	- 4%	0%
80 GM only	9	Test 1	1.75	31.20	2.18	16.25
		Test 2	1.25	15.13	2.54	16.55
		Change 1-2	-29%	-52%	+17%	+ 2%
		Final	1.14	13.13	2.08	16.56
		Net Change	-35%	-58%	- 5%	+ 2%
80 Non-GM	12	Test 1	1.64	29.39	1.65	22.55
		Test 2	1.27	24.47	1.65	22.23
		Change 1-2	-23%	-17%	0%	- 1%
		Final	1.24	24.60	1.60	22.20
		Net Change	-24%	-16%	- 3%	- 2%

Table 4 shows the emission reductions for vehicles in the sample which legitimately passed the I/M reinspection. These vehicles had lower average emissions after repair than the average for the whole sample, because the vehicles which should not have passed the reinspection tended to have high after-repair FTP emissions.

Table 4
Average FTP Scores, Correctly Reinspected Vehicles

Model Year	N		HC (g/mi)	CO (g/mi)	NOx (g/mi)	Fuel Economy (mi/gal)
81	50	Test 1	1.74	31.26	1.12	19.77
		Test 2	1.07	18.72	1.25	20.11
		Change 1-2	-38%	-40%	+12%	+ 2%
		Final	1.00	16.63	1.11	20.25
		Net Change	-42%	-47%	- 1%	+ 2%
80	20	Test 1	1.39	24.60	1.91	20.27
		Test 2	0.99	13.98	2.09	20.35
		Change 1-2	-29%	-43%	+ 9%	0%
		Final	0.93	13.16	1.85	20.33
		Net Change	-33%	-47%	- 3%	0%
80 GM only	8	Test 1	1.72	29.36	2.13	16.37
		Test 2	1.21	12.05	2.53	16.58
		Change 1-2	-30%	-59%	+19%	+ 1%
		Final	1.08	9.80	2.02	16.59
		Net Change	-37%	-67%	- 5%	+ 1%
80 Non-GM	12	Test 1	1.17	21.42	1.77	24.09
		Test 2	0.85	15.27	1.79	23.97
		Change 1-2	-27%	-29%	+ 1%	- 1%
		Final	0.82	15.39	1.73	23.93
		Net Change	-30%	-28%	- 2%	- 1%

7Table 5 shows the average emissions for vehicles in the sample which correctly failed the initial inspection and correctly passed the reinspection, combining the effects shown in Tables 3 and 4.

Table 5
Average FTP Scores
Correct Failure and Correct Reinspection

Model Year	N		HC (g/mi)	CO (g/mi)	NOx (g/mi)	Fuel Economy (mi/gal)
81	37	Test 1	2.17	39.76	1.17	18.58
		Test 2	1.23	20.60	1.35	19.25
		Change 1-2	-43%	-48%	+15%	+ 3%
		Final	1.15	18.12	1.15	19.46
		Net Change	-47%	-54%	- 2%	+ 5%
80	17	Test 1	1.48	27.28	1.89	20.00
		Test 2	0.96	14.16	2.10	20.20
		Change 1-2	-35%	-48%	+11%	+ 1%
		Final	0.88	13.19	1.82	20.19
		Net Change	-41%	-52%	- 4%	+ 1%
80 GM only	7	Test 1	1.65	30.20	2.07	16.43
		Test 2	0.94	8.89	2.57	16.83
		Change 1-2	-43%	-71%	+24%	+ 2%
		Final	0.80	6.32	1.98	16.85
		Net Change	-52%	-79%	- 4%	+ 2%
80 Non-GM	10	Test 1	1.36	25.23	1.76	23.58
		Test 2	0.98	17.85	1.77	23.49
		Change 1-2	-28%	-29%	+ 1%	0%
		Final	0.94	18.00	1.71	23.44
		Net Change	-31%	-29%	- 3%	- 1%

Vehicle #231 correctly failed the initial test, but should not have passed the reinspection. It is the only such car which received contractor maintenance. The contractor was able to reduce its idle emissions so that it would have passed. Table 6 shows the average emissions for the group described in Table 5 with vehicle #231 included.

Table 6
Average FTP Scores
As Table 5, but including Vehicle #231

Model Year	N		HC (g/mi)	CO (g/mi)	NOx (g/mi)	Fuel Economy (mi/gal)
81	38	Test 1	2.14	39.06	1.19	18.62
		Test 2	1.42	24.82	1.32	19.11
		Change 1-2	-34%	-36%	+11%	+ 3%
		Final	1.13	17.77	1.14	19.50
		Net Change	-47%	-55%	- 4%	+ 5%

4.0 Repair Comments

The comments of the contractor's mechanic (Appendix B) list the results of his examinations of the cars for each test sequence. The examinations provide information about the condition of the cars at the time of each test. In the first examination, the mechanic described the vehicle as received, in the condition in which it failed the I/M test. The examination gives clues about why it failed. In his examination accompanying the second test, the mechanic described the condition of the car as it passed the reinspection. He assessed any new or continuing problems which were present. The comments on the second test sequence also list what repairs were done, as reported by the vehicle owner, and attempt to include their cost. The comments accompanying the third test sequence list repairs done by the contractor and any problems which were not repaired. This section summarizes the comments, discussing the common emission-related malfunctions and the effectiveness of commercial repairs. The complete sample of twenty-four 1980 model year vehicles and fifty-four 1981 model year vehicles is discussed.

Of particular interest in this study are design features which distinguish the 1980 and later model year vehicles from older models such as closed loop control systems and limited adjustment carburetors. There were three cases of malfunctioning closed loop systems among the forty-one vehicles which have such systems. Two of these caused extremely high FTP emissions, and were successfully repaired by replacement of the oxygen sensors. Both vehicles had been super emitters, among the worst in the whole group, and were brought close to the FTP standards by the repairs. They also showed roughly 40% improvements in fuel economy after the repairs. It must be noted that one of these vehicles did not have high emissions as received; it became a super-emitter after the commercial repairs. (See comments on vehicle #231 in Appendix B for more details.) The third case of a closed-loop system problem caused higher than average emissions, and was successfully repaired through replacement of an unspecified "three-way" part.

Sealed parameter carburetors were used in 1980 model year GM cars and are used on all later model year cars. These carburetors have plugs which discourage the novice mechanic from adjusting the air-fuel mixture. Mechanics are able to permanently remove the plugs. A carburetor missing these plugs has probably been adjusted. Four of the ten 1980 GM cars entered this study with missing mixture plugs. A fifth had its plugs removed during the commercial repairs. Of the fifty-four 1981 cars, ten (18.5%) entered the study without the plugs, and two more had them removed by commercial repair facilities. The

FTP emissions of this group were not significantly higher than the average for the whole sample. The proportion of the group within the sample, roughly 20% for 1981 cars, agrees with that found in recent EPA tampering surveys.

Though not a new technology, air injection became common in the late seventies. Problems with air injection systems are a known cause of I/M failures. Twenty-two (92%) of the 1980 vehicles and forty-seven (87%) of the 1981 vehicles were equipped with these systems. The mechanic noted that these systems were malfunctioning in four (18%) of the 1980 cars and sixteen (34%) of the 1981 cars. The FTP emissions of this group were not significantly different from the sample average. Most of these malfunctions were associated with diverter valves, which tended to stick or were not properly actuated.

The mechanic reported that thirty-seven (47%) of the vehicles had timing misadjustments of at least two degrees. The range of misadjustment was +8° to -14°. More vehicles had retarded timing than advanced. Twenty-five vehicles had misadjusted timing after the commercial repairs.

Eight vehicles (10%) arrived with excessively dirty air filters. Some of these were replaced during commercial maintenance. Other less dirty air filters were also replaced. Thirteen (17%) cars had dirty or worn spark plugs. Commercial repair facilities usually did not specify that they replaced the plugs, beyond stating that major or minor tune-ups were done. As with the air filters, spark plugs were replaced that perhaps did not need to be. Twelve cars (15%) entered the program with damaged, leaking, or misrouted hoses. Some of these cases were repaired, but five new cases were noted after the commercial repairs. Ten cars (13%) had malfunctioning heated air systems. Some were repaired, but two more were noted after commercial repairs. There were nine cases (12%) of choke problems. Again, some were repaired and two more appeared. Seventeen cars (22%) arrived with faulty EGR systems. Twelve cars (15%) showed evidence of misfueling (damaged inlet restrictor, fuel lead above unleaded standard, or lead deposits detected in the tailpipe -- these indications were usually not recorded in the comments, as they were coded into the computerized dataset). None of these problems can be singled out as causing emissions to be higher than others, because the sample sizes are so small.

The average repair bill was about $95 for both model years. This figure is approximate, as the comments do not include cost data for all cars, and some of the bills included costs for non-I/M repairs. Major carburetor repairs were among

the most expensive, often costing over $200. Commercial repair facilities conducted twelve of these repairs. One of these caused a large decrease in FTP emissions, and one caused a large increase. The rest had mixed small changes. Four of the cars which received major carburetor work scored close to or below the standards on the first FTP, and another has been classified as a false I/M failure, indicating that these expensive repairs were unnecessary in some cases.

Twenty-five cars (32%) received tune-ups, which cost roughly $50 - $100. Tune-ups were often done after carburetor repair work, further boosting repair costs. Some vehicles received more than one tune-up before passing the reinspection. It is not evident how a second tune-up would differ from the first.

Maintenance by the contractor was more successful in reducing FTP emissions than that of commercial facilities. Again, it should be noted that the goal of the contractor's mechanic was to reduce FTP emissions of HC, CO, and NOx rather than to pass the I/M test. There were not enough of these repairs to allow statements about the success of particular types of repairs. The mechanic avoided tune-ups in favor of specific adjustments. In some cases he did not perform all possible repairs, in an attempt to isolate the effects of individual repairs, so even more reductions than he achieved were available. Some cars left the program with unexplained high emissions.

The following general conclusions can be drawn from the mechanic's comments:

1. The problems addressed by both the commercial mechanic and the contractor's mechanic tended to be related to traditional I/M problems (e.g., ignition timing, air filters, tune-ups, etc.) rather than to new technology components. This is despite the fact that malfunctioning closed-loop systems caused very high emissions in some cases.

2. Many cars had their air/fuel mixture plugs removed. However, it is not clear whether the removals caused lower emissions by allowing proper adjustment of the mixture or whether they caused higher emissions by allowing improper adjustments.

3. The contractor's mechanic noted some problems during the second test sequence which were not present during the first, indicating poor work during the commercial repairs.

4. In some cases emissions increased after commercial repairs.

5. Some vehicles received expensive repairs which probably were not necessary. Other less expensive repairs were also unnecessarily conducted.

6. Some vehicles had to undergo repairs more than once in order to pass reinspection.

This evidence indicates that some commercial repair facilities may not be competent, equipped, or motivated to perform correct diagnosis and repair.

5.0 Conclusions

This study showed that average emissions from new technology vehicles were reduced by the I/M program in Washington, D.C. during the spring and summer of 1984. It also showed that this benefit would be increased with improved quality assurance. Individual vehicles within the study had increased idle and FTP emissions after I/M, indicating that they received possibly inappropriate repairs. Many of the vehicles in the program seemed to have problems with conventional emission-related components. The few which had malfunctions in new technology components were among the highest of emitters. They showed large reductions when properly repaired. This study also indicates that the air quality be[illegible]it and the cost-effectiveness of I/M for new technology vehicles, like old technology vehicles, could be improved by efforts being directed at improving the diagnosis and repair of vehicles which fail I/M tests.

Appendices

A Miscellaneous Information About the Vehicles

B Comments of the Contractor's Mechanic

C Results of Federal Test Procedures

D Results of Idle-Neutral Modes of Short Tests during the First Test Sequence

E Results of Idle-Neutral Modes of Short Tests of Vehicles Which had High Idle Emissions After Commercial Repairs

Appendix A: Miscellaneous Information About the Vehicles

VEHICLE NUMBER	MANUF. /YEAR	ENGINE SIZE	MILEAGE	FUEL SYSTEM	CATALYST TYPE	CONTROL CONFIG.	CO (FTP) STANDARD
2	FORD/80	250	59676	CARB	OXID	N/A	7.00
4	FORD/80	140	13900	CARB	OXID	N/A	7.00
5	TOYOTA/80	108	45336	CARB	OXID	N/A	7.00
8	VWA/80	89	40063	CARB	OXID	N/A	7.00
14	FORD/80	98	62437	CARB	OXID	N/A	7.00
17	GM/80	301	32110	CARB	OXID	N/A	7.00
19	VWA/80	97	45281	PORT FI	OXID	N/A	7.00
20	NISSAN/80	91	97562	CARB	OXID	N/A	7.00
21	FORD/80	200	79754	CARB	OXID	N/A	7.00
24	VWA/80	97	42925	PORT FI	OXID	N/A	7.00
26	FUJI/80	97	63230	CARB	OXID	N/A	7.00
28	NISSAN/80	85	46063	CARB	OXID	N/A	7.00
29	NISSAN/80	75	57791	CARB	OXID	N/A	7.00
39	GM/80	350	68604	CARB	OXID	N/A	7.00
40	GM/80	231	48217	CARB	OXID	N/A	7.00
41	GM/80	301	38025	CARB	OXID	N/A	7.00
42	GM/80	301	33654	CARB	OXID	N/A	7.00
43	GM/80	231	59602	CARB	OXID	N/A	7.00
46	GM/80	173	53097	CARB	OXID	N/A	7.00
47	GM/80	368	37135	CARB	OXID	N/A	7.00
48	GM/80	260	59599	CARB	OXID	N/A	7.00
49	GM/80	301	35004	CARB	OXID	N/A	7.00
51	MITSUBISHI/80	156	60793	CARB	OXID	N/A	7.00
52	FORD/80	140	39522	CARB	OXID	N/A	7.00
102	FORD/81	302	47179	CARB	OX3W	CL.LOOP	3.40
103	GM/81	307	33374	CARB	OX3W	CL.LOOP	3.40
104	GM/81	173	19234	CARB	3WAY	CL.LOOP	7.00
105	CHRV/81	135	19959	CARB	OX3W	CL.LOOP	7.00
108	GM/81	98	28216	CARB	3WAY	CL.LOOP	7.00
109	GM/81	307	29266	CARB	OX3W	CL.LOOP	3.40
111	GM/81	173	36665	CARB	OX3W	CL.LOOP	7.00
115	GM/81	151	35171	CARB	OX3W	CL.LOOP	3.40
120	MITSUBISHI/81	86	37061	CARB	OXID	N/A	3.40
121	TOYOTA/81	89	39336	CARB	OXID	N/A	7.00
124	FORD/81	302	45461	CARB	3WAY	CL.LOOP	3.40
126	TOYO.KOGYO/81	120	36245	CARB	3WAY	OP.LOOP	7.00
127	GM/81	98	60627	CARB	3WAY	CL.LOOP	7.00
130	FORD/81	255	55593	CARB	OX3W	CL.LOOP	3.40
131	GM/81	98	32638	CARB	3WAY	CL.LOOP	7.00
133	FORD/81	302	25784	CARB	OX3W	CL.LOOP	3.40
134	GM/81	231	33280	CARB	3WAY	CL.LOOP	7.00
135	HONDA/81	107	72567	CARB	OXID	N/A	3.40
139	NISSAN/81	75	25294	CARB	OXID	N/A	3.40
144	GM/81	98	39314	CARB	3WAY	CL.LOOP	7.00
145	NISSAN/81	91	19237	CARB	OXID	N/A	3.40
146	GM/81	98	27372	CARB	3WAY	CL.LOOP	7.00
156	FORD/81	200	29254	CARB	OX3W	OP.LOOP	3.40
157	GM/81	231	46775	CARB	3WAY	CL.LOOP	7.00
158	NISSAN/81	91	40758	CARB	OXID	N/A	3.40
159	FORD/81	200	36314	CARB	OX3W	OP.LOOP	3.40
161	FORD/81	302	61153	CARB	3WAY	CL.LOOP	3.40
162	NISSAN/81	119	50479	CARB	OXID	N/A	3.40
169	GM/81	231	29235	CARB	3WAY	CL.LOOP	7.00
171	GM/81	98	43422	CARB	3WAY	CL.LOOP	7.00
172	GM/81	97	25189	CARB	3WAY	CL.LOOP	7.00
175	GM/81	231	27100	CARB	3WAY	CL.LOOP	7.00
177	GM/81	231	34777	CARB	3WAY	CL.LOOP	7.00
179	FIAT/81	122	6679	PORT FI	3WAY	CL.LOOP	3.40
182	GM/81	173	55150	CARB	3WAY	CL.LOOP	7.00
192	GM/81	98	34113	CARB	3WAY	CL.LOOP	7.00
199	CHRV/81	135	35296	CARB	OX3W	CL.LOOP	7.00
204	VOLVO/81	130	49743	PORT FI	3WAY	CL.LOOP	3.40
211	TOYO.KOGYO/81	91	21004	CARB	OX3W	OP.LOOP	7.00
213	BMW/81	108	12330	PORT FI	3WAY	CL.LOOP	3.40
221	CHRV/81	135	57332	CARB	OX3W	CL.LOOP	7.00
223	GM/81	98	59709	CARB	3WAY	CL.LOOP	7.00
228	NISSAN/81	146	67031	PORT FI	3WAY	CL.LOOP	3.40
230	CHRV/81	225	43937	CARB	OXID	N/A	7.00
231	NISSAN/81	168	44804	PORT FI	3WAY	CL.LOOP	3.40
234	GM/81	98	39697	CARB	3WAY	CL.LOOP	7.00
245	GM/81	231	26575	CARB	3WAY	CL.LOOP	7.00
257	GM/81	98	28240	CARB	3WAY	CL.LOOP	7.00
258	FORD/81	302	67516	CARB	3WAY	CL.LOOP	3.40
266	FORD/81	302	49614	CARB	OX3W	CL.LOOP	7.00
268	FORD/81	98	40693	CARB	OX3W	OP.LOOP	7.00
270	CHRV/81	135	21443	CARB	3WAY	CL.LOOP	7.40
272	GM/81	307	70147	CARB	OX3W	CL.LOOP	3.40
274	AUDI/81	105	27574	PORT FI	3WAY	CL.LOOP	3.40

Appendix B: Comments of the Contractor's Mechanic

VEH#	TEST SEQ.*	FTP RESULTS (g/mi) HC	CO	NOX	COMMENTS
2	A	4.03	55.76	1.23	HEATED AIR DOOR ASSY MSG. IDLE MIXT LIM DEVICE MSG. CHOKE LEAN. TIMING 4 DEG LOW. SPARK WIRES SHORTING. AIR BYPASS VALVE DISC. DIVERTOR VALVE STUCK. HEAD GASKET LEAKING. NO D.C. FAILURE RESULTS GIVEN.
	B	2.74	45.82	1.24	NO LABEL. TEMP SENSOR IN AIR CLEANER IS CONNECTED TO DIVERTOR VALVE. OIL 2 QTS LOW. REBUILT CARB AND TUNE TO PASS INSP FOR $220.37.
4	A	2.04	44.61	1.00	IDLE MIXTURE LIMITER MISSING. FAILED HC-315 AND CO-8.75% AT LANE.
	B	2.74	69.38	.84	IDLE CO STILL RICH. SERVICE STN IN D.C. PUT IN A NEW BATTERY AND SPARK PLUGS AND GAVE IT A REINSP TO PASS. REPAIRS COST $128.05 INCLUDING THE NEW BATTERY AT $73.09 INCL TAX. UNCLEAR WHETHER OWNER REQUESTED NEW BATTERY ASIDE FROM I/M REPAIR. IF SO, I/M REPAIR COST $54.96, INCL REINSP FEE.
5	A	1.51	23.63	1.09	IDLE AND FAST IDLE SPEEDS HIGH. FAILED CO AT LANE - 4.5%.
	B	.79	9.37	1.40	IDLE SPEED STILL A LITTLE HIGH. TIMING -5 DEG FROM SPEC, WAS +2 DEG FROM SPEC. NEW AIR FILTER IS NOT THE CORRECT SIZE. SERVICE STN GAVE ADJ FOR $15.90.
8	A	1.36	23.10	.59	EGR VALVE APPEARS TO BE STUCK. VALVES OUT OF ADJ. FAILED CO AT LANE - 5.27%, SPEC 1.5%.
	B	.73	13.13	.47	OWNER GOT CARB OVERHAUL IN VIRGINIA FOR $223.98.
14	A	3.07	62.33	1.07	AIR PUMP SYSTEM DISABLED. BYPASS HOSE PLUGGED IN 2 PLACES. TIMING 4 DEGREES LOW, IDLE SPEED 350 HIGH. FAST IDLE SPEED LOW. FAILED AT LANE HC-448 (SPEC 300) AND CO-8.05%, (SPEC 1.5%).
	B	2.29	50.21	1.61	AIR SYSTEM STILL DISABLED. TIMING 4 DEGREES LOW. IDLE SPEED 90 RPM HIGH. MIXTURE CAP MSG. FAST IDLE SPEED LOW. EGR LINE DISCON. CAR GIVEN MINOR TUNE-UP TO PASS TEST. COST $45.95.
17	A	2.24	23.49	2.54	NO STICKER FOR ENGINE FAMILY. HEATED AIR DOOR STUCK. IDLE SPEED +300 CHOKE RICH. CHOKE LIMITER ALTERED. TIMING +8 DEG OVER SPEC. PCV HOSE COLLAPSED. FAILED AT LANE HC-393.
	B	3.07	34.20	2.28	NO SIGNIF CHANGES. OWNER SAID HE PUT IN NEW AIR FILTER, CLEANED UP HIS CAR, AND PASSED REINSP.
19	A	.43	4.39	2.50	OK. CAR FAILED CO AT LANE - 2.76%.
	B	.44	4.87	2.16	OWNER SPENT $152.12 FOR TUNE-UP, BUT STILL FAILED CO AT LANE. OWNER REPORTED TRYING 3 TIMES AT THE LANE BEFORE HE PASSED.
20	A	.57	8.80	.77	CO IS IN SPEC 2.0 + OR - 1.0 AT LAB. IDLE RPM 600 HIGH. CARB & FILTERS VERY DIRTY, OIL LEAKAGE. FAILED CO AT LANE.
	B	.42	4.31	1.02	OIL IS VERY DIRTY. ENGINE HAS MINOR OIL LEAKAGE. CARBURETOR IS SLIGHTLY DIRTY. FAST IDLE SPEED SPECIFICATIONS NOT AVAILABLE. IDLE SPEED 350 RPM HIGH. PAID ABOUT $20, NOT INCLUDING A LOT OF MUFFLER WORK, FOR A RE-INSP AT A DC AMOCO STN. UNCLEAR IF ANY ADJ MADE.
21	A	1.41	9.71	2.31	BROKEN VAC LINE TO HAI SYSTEM. TIMING +4 DEG FROM SPEC. AIR FILTER VERY DIRTY. AIR PUMP DUMPS VERY SOON AT IDLE. FAILED AT LANE, HC-371 AND CO-1.9%.
	B	1.53	9.50	1.81	AIR PUMP DUMPS CONTIN. EMISSIONS CLEAN WITH VACUUM APPLIED TO DIVERTOR. CAR MAY HAVE IDLED TOO LONG. DELAY VALVE IN DIVERTOR BLEEDS DOWN. SERVICE STN GAVE MINOR MAINT WITH NO APPARENT ADJUSTMENTS FOR $31.90.

* TEST SEQUENCE A IS OF THE VEHICLE IN THE CONDITION RECIEVED; SEQUENCE B IS OF THE VEHICLE AFTER COMMERCIAL REPAIR; SEQUENCE C IS OF THE VEHICLE AFTER REPAIRS DONE BY THE CONTRACTOR (IF ANY).

VEH#	TEST SEQ.	FTP RESULTS (g/mi) HC	CO	NOX	COMMENTS
22	A	1.38	15.79	1.81	ENGINE DOES NOT IDLE WHEN COLD. CHOKE NOT WORKING, NO FAST IDLE. IDLE CO HIGH ONCE, BUT LOW DURING SHORT TESTS. FAILED HC-582 AND CO-3.9% AT LANE. VEHICLE AT ONE TIME DID NOT HAVE A CATALYST IN IT AND OWNER USED LEADED FUEL, HAS CATALYST NOW.
	B	2.51	27.82	1.82	OWNER DID MINOR MAINT, BUT STILL FAILED INSP FOR 2 TRIES. THEN WENT TO AN AUTHORIZED REINSP GAS STATION AND WAS PASSED FOR $30.18, BUT NO REPAIRS MADE.
24	A	.11	1.09	2.13	SEEMS OK. IDLE CO GENERALLY ONLY .02% ON SHORT TESTS. BUT SHOWED 1.3% AT LAB INSP. FAILED CO AT LANE-2.99%, LIMIT 1.5%. OWNER HAS HAD CATALYST REPLACED BY DEALER.
	B	.10	.99	2.04	OWNER SAID HE GOT AN ADJUSTMENT "SET TO SPEC" TO PASS - NO RECEIPT.
26	A	.15	9.99	1.52	RPM 100 LOW. CO ON SHORT TESTS LOW, BUT ON UNDERHOOD INSP WAS 1.35%. FAILED CO AT LANE-1.8%.
	B	.17	5.52	1.58	IDLE RPM VARIES FROM -50 TO +200 FROM SPEC. A DC AMOCO STN GAVE "ADJ CARB" & RE-INSP FOR $29.10.
28	A	.30	3.71	1.47	TIMING +4 DEG. IDLE EMISSIONS ALL LOW, EXCEPT DURING ECOMP INSP IN WHICH CO WAS 5%, APPARENTLY DUE TO LONG IDLE. FAILED AT LANE, CO-4.72%.
	B	.33	3.70	1.66	OWNER PAID $16.00 FOR AN ADJUSTMENT, BUT NO ADJ APPEARS TO HAVE BEEN MADE. NOR WAS ONE NECESSARY.
29	A	.65	12.17	1.82	IDLE MIXTURE IS TOO RICH. RPM +230. FAILED AT LANE HC-578 & CO-15%. LIMITS 300 & 1.5%.
	B	.28	2.50	1.96	RPM +300, TIMING -2 DEG. TUNE-UP FOR $112.27 BY GARAGE IN DC (INCLUDES ABOUT $25 OF OTHER).
39	A	.74	2.64	3.31	IDLE SPEED +100. EGR VALVE STUCK. FAILED AT LANE, HC - 448 PPM.
	B	.63	3.76	3.26	CAR IS CLEAN. OLDS DLR SET ENG TO SPEC & ADJ CARB, LUBED EGR VALVE WHICH WAS STICKING. NO COST INFO.
40	A	1.12	9.34	1.26	NO BUILD DATE AVAILABLE. TIMING 9 DEG LOW, ONE VAC LINE DAMAGED, CARB AND PCV SYSTEM VERY DIRTY. FAILED HC AT LANE-495.
	B	1.26	12.02	1.81	CARB TOO LEAN OR VACUUM LEAK SOMEPLACE. OWNER PAID $185.82 TO OVERHAUL CARB AND ADJ.
41	A	1.69	34.82	1.41	NO BUILD DATE AVAILABLE. SPARK PLUGS INCORRECTLY GAPPED AND WORN. MIXTURE PLUGS ARE PUNCHED OUT. AIR CONDITIONER COMPRESSOR DRIVE BELT BROKE. RPM +160. ALL IDLE EMISSIONS HIGH, OFF-IDLE LOW. SEC VAC BREAK RICH. FAILED AT LANE CO-5.75%, LIMIT 1.5%.
	B	.91	6.23	1.67	NO BUILD DATE AVAILABLE. NO LEAD SAMPLE FOR FUEL. RPM +300. OWNER PAID $87.00 FOR UNKNOWN REPAIRS.
42	A	2.19	36.13	3.17	TIMING 4 DEG LOW, PRIMARY VAC BREAK RICH, CHOKE VAC DIAPHRAGM LEAKS. FAILED AT LANE HC-687 AND CO-15%, NO RECEIPT.
	B	3.06	51.31	3.04	PCV CRACKED. EGR APPEARS STUCK. OWNER WENT TO 2 STNS FOR TUNE-UP. REPAIRS WERE PAID ABOUT $100. WAS PASSED BY A THIRD STATION.

VEH#	TEST SEQ.	FTP RESULTS (g/mi) HC	CO	NOX	COMMENTS
43	A	2.41	57.89	1.43	EVAP VENT LINE DAMAGED. PCV AND OTHER HOSES OIL SOAKED OR HEAT HARDENED. ONE SIDE OF AIR SYSTEM DISABLED. ENGINE IDLE SPEED IS ERRATIC, TIMING +5 DEG. FAILED AT LANE CO-5.92%.
	.B	1.32	11.55	4.97	AIR FILT ELEM DIRTY. IDLE MIXT PLUGS PUNCHED OUT. SPARK PLUGS WORN. DIVERTER VALVE IS LEAKING VAC CHECK VLV MISSING. TMG ERRATIC (POSSIBLE). TMG CHAIN PROB. IDLE SPD +500. CHEVY DLR REPL CANNISTER & MISC FOR $93.65 AND SERV STN GAVE REINSP & CARB ADJ (?)
	C	.52	3.05	1.85	TIMING IS TOO ERRATIC TO MEASURE. DLR REPL AIR PIPE & CHK VALVE FOR $58.69. AT LAB DIRECTION & LAB RECONN AN EGR HOSE.
46	A	1.39	22.03	3.28	FUEL ANALYSIS NOT AVAILABLE. TIMING 2 DEG LOW, FAST IDLE HIGH. FAILED CO AT LANE 1.62%.
	B	1.30	16.87	3.11	PCV VALVE DIRTY. PCV HOSES ARE OIL SOAKED AND HARD. EVAP CANISTER FILTER IS DIRTY. CARB FLOAT BOWL HOSE TO CANISTER IS OFF. COOLANT LEVEL LOW. EGR VALVE AND INTERNAL BACK PRESSURE TRANSDUCER NOT WORKING. INIT TIMING IS 2 DEG RETARDED. GULF STN DID UNKNOWN REPS FOR $123.
	C	1.09	7.38	2.11	CATALYST LKS ON BOTTOM. EXCESSIVE EXTERNAL OIL LEAKAGE. REPL PCV VALVE. REPLACED PCV HOSES. REPLACED EVAPORATIVE CANISTER FILTER. REPLA EGR VALVE. RECONNECTED CANISTER FLT BOWL HOSE. FILLED COOLANT TO PROPER LEVEL. ADJ INITIAL TIMING TO 8 DEG BTDC.
47	A	3.23	82.40	1.13	IDLE MIXTURE TOO RICH. FUEL ANALYSIS NOT AVAILABLE. TIMING 4 DEG LOW. MIXTURE LIMITER MISSING. FAILED CO AT LANE -4.9%, PASSED HC AT 262 PPM.
	B	.55	9.09	1.56	IDLE MIXTURE PLUGS BROKEN OUT. CARBURETOR FLOAT BOWL VENT HOSE IS DETERIORATED FAST IDLE SPEED GREATER THAN SPEC. IDLE CO LEAN. IDLE SPEED +100. CAD DLR ADJ CARB, TIMING, CHOKE FOR $120.75.
48	A	.94	2.29	2.70	DISTRIBUTOR BOLT LOOSE. PCV HOSE HEAT HARDENED. IGNITION TIMING VARIABLE DUE TO DISTRIBUTOR BOLT LOOSE. CHOKE DIAPHRAGM LEAKS. FAILED HC - 1739 AT LANE.
	B	.64	2.69	1.60	HEATED AIR DUCT DAMAGED. CARB EXCEPTIONALLY DIRTY. IDLE MIX PLUGS PUNCHED OUT. EFE VLV IS FROZEN. PCV VLV EXCEPTIONALLY DIRTY. OIL LEAKAGE UNDER CAR. INIT TMG IS 14 DEG RETARD. DIST HOLD DOWN BOLT IS LOOSE. FAST IDLE SPEED IS GRTR THAN SPEC. PLUMBTESMO POSITIVE. DEALER DID REPS FOR $38.
49	A	2.03	33.30	1.92	ALL IDLE CONDITIONS SHOW HIGH HC & CO, OFF IDLE OK. IDLE MIXTURE LIMITER MISSING. FAILED HC & CO AT LANE.
	B	1.57	22.68	1.80	CARB IS SLIGHTLY GUMMED UP. IDLE MIXTURE SCREWS ARE UNCAPPED. SECOUNDARY VACUUM BREAK DIAPHRAGM IS LEAKING. FAST IDLE SPEED LOWER THAN SPECIFIED. EXXON STN GAVE TUNE-UP FOR $47.70.
51	A	3.38	75.00	3.22	CARBURETOR ASSEMBLY IS LEAKING FUEL. VACUUM ADVANCE DIAPHRAGM LEAKS. PCV FILTER MISSING. OIL IS EXCEPTIONALLY DIRTY. COOLANT LEVEL EXCEPTIONALLY LOW. FAST IDLE SPEED LOW. IDLE SPEED -160. TIMING +3 DEG. FAILED HC:900 & CO:15% AT LANE.
	B	1.93	50.33	3.04	OWNER PAID $36.99 FOR CARB ADJ & RE-INSP AT TIRE DLR.
	C	1.57	51.88	2.38	INSTALLED NEW CARB AND AIR FILTER.
52	A	1.06	23.16	2.70	AIR CLEANER TEMP SENSOR DEFECTIVE. IDLE MIXTURE LIMITING DEVICE IS MISSING. SPARK PLUGS ARE WORN. OIL LEVEL EXCESSIVELY LOW. ENGINE COOLANT RUSTY. FAST IDLE SPEED GREATER THAN SPEC. IDLE SPEED IS +120 RPM. FAILED CO AT LANE:7.08%.
	B	1.20	28.75	2.69	HOSE OFF EGR TVS. TIMING -3 DEG, IDLE RPM +100, CARB RICH. FORD DLR GAVE CARB OVERHAUL. TUNE-UP AND RE-INSP FOR $333.05.

VEH#	TEST SEQ.	FTP RESULTS (g/mi) HC	CO	NOX	COMMENTS
102	A	2.22	27.48	1.31	AIR BYPASS/DIVERTOR VALVE STUCK. FAILED AT LANE, HC-735, CO-11%.
	B	1.49	18.97	.69	THE DIVERTOR VALVE DUMPS OFF IDLE CONTINOUSLY, MAY BE ELECTRICAL OR COMPUTER BOX. MAY HAVE DAMAGED CONVERTOR. I CAN HEAR DUMPING, SHOULD NOT HAVE BEEN DIFFICULT TO CORRECT. OWNER GOT TUNE, NEW EGR, AND REBUILT CARB BY 2 PLACES FOR TOTAL $278.34.
103	A	1.48	14.00	1.58	CHOKE MALADJUSTED RICH. FAILED CO AT LANE AT 2.25%.
	B	2.88	93.86	1.38	CHOKE IS RIVETED AND CANNOT BE SET. CODES 24 AND 35 SET. MIXTURE SOLENOID GOING RICH. OWNER SPENT $350.99 ON TWO TUNE-UPS, CARB OVERHAUL.
104	A	.38	5.19	2.78	IDLE SPEED 200 RPM HIGH. TIMING +6 DEG OVER SPEC. IDLE MIX LIM DEVICE ALTERED. CHOKE VAC HOSE DISCONNECTED. EGR TVS DISCONNECTED & HOSES MISROUTED. FAILED HC AT 671 AND CO AT 13% AT LANE.
	B	.27	3.25	2.54	HEATED AIR DOOR TEMP SENSOR INOP BY VAC LINE PLUGGED. IDLE SPEED STILL HIGH. TVS VAC LINE TO CHOKE PRIMARY VAC BREAK AND EGR STILL DISABLED. TIMING STILL HIGH. BUICK DEALER REPLACED ECM. SAVING CODE 54&55 DISPLAYED, NO APPARENT CHARGE.
	C	.25	3.12	1.47	FIXED TVS SO EGR AND CHOKE WORKING.
105	A	1.16	14.42	1.19	IDLE MIXTURE RICH. COOLANT TEMP SENSOR HAS BAD CONNECTION. FAILED AT LANE HC-445 (SPEC 300), AND CO 4.06% (SPEC 1.5%).
	B	.97	13.14	1.19	TIMING AND IDLE SPEED MEASURED DIFF THAN BEFORE BUT NO APPARENT ADJUSTMENTS WERE MADE BY GARAGE. SERV STN CHG $11.13 FOR REINSP.
108	A	.39	6.70	.35	NO EMISSION LABEL. ALL ELSE OK. IDLE SPEED +180, TIMING -3 DEG FAILED CO AT LANE - 4.88%.
	B	.34	5.60	.34	NO LABEL. IDLE SPEED AND TIMING SAME. DEALER IN D.C. CLEANED CARB AND TUNED ENG FOR EST $186.04.
109	A	10.30	179.85	.73	CODE 13 - POSSIBLE O2 CIRCUIT RICH. EGR VALVE APPEARS TO BE STUCK. AIR FILTER VERY DIRTY. HIGH CO AT ALL CONDITIONS. OWNER REPORTEDLY HAD A DEALERSHIP TUNE-UP WITHIN LAST 3 MONTHS FOR $125.00. FAILED AT LANE HC-799 & CO-8.44%.
	B	1.80	10.93	2.21	OK. OWNER REPORTED HAVING NEW EGR INSTALLED, CARB OVERHAULED & MAJOR TUNE-UP BY SAME DEALER.
111	A	.31	5.11	1.60	MIXT LIM DEVICE BROKEN. IDLE CO GOES RICH AFTER SHORT IDLE PERIOD. TIMING -4 DEG FROM SPEC. EGR VAC LINE PLUGGED. AIR DOWNSTREAM AIR LINE KINKED OIL 1 1/2 QTS HIGH. FAILED CO AT STATE LANE AT 4.76%.
	B	.29	2.13	1.47	CHOKE IS RIVETED AND CANNOT BE SET. AIR AND EGR HOSES SAME CONDITION. GOT TWO TUNE-UPS FOR $83.75.
115	A	.53	19.87	1.32	BUILD DATE NOT AVAILABLE. CODES 34, 35 & 55 STORED. FAILED CO AT LANE-4.64%, LIMIT 1.5%.
	B	.49	18.76	1.53	CHOKE NON-ADJUSTABLE, RIVETED. SAME CODES STILL STORED. IDLE CO VARIES, SOMETIMES LOW, SOMETIMES HIGH. PAID $99.37 FOR A TUNE-UP & RE-INSP AT A DC EXXON STN.
120	A	.46	8.60	1.61	IDLE MIXT LIM ALTERED. IDLE SPEED +400. IDLE CO MEASURED HIGH DURING UNDERHOOD INSP., BUT VERY LOW DURING SHORT TESTS. FAILED CO AT LANE.
	B	.48	8.29	1.81	IDLE SPEED +700 NOW. DEALER PERFORMED 36K MAINTENANCE INTERVAL BUT ONLY APPEARED TO ADJUST THE IDLE SPEED, COST $75.87, AND GAVE CAR REINSP TO PASS.

VEH#	TEST SEQ.	FTP RESULTS (g/mi) HC	CO	NOX	COMMENTS
121	A	.22	2.76	.81	RPM +250. TIMING +6 DEG. EMISSIONS VERY LOW ON ALL SHORT TESTS, BUT FAILED AT LANE. HC-499, LIMIT 300.
	B	.26	3.19	.77	RPM & TIMING SAME. SEARS GAVE ENGINE DIAGNOSIS AND TUNE-UP FOR $69.90.
124	A	3.68	27.44	2.67	IDLE SPEED +180, AIR BYPASS VALVE STUCK. FAILED HC-1105 AND CO-3.87% AT LANE.
	B	2.94	28.11	1.92	FAST IDLE SPEED GREATER THAN SPECIFIED. DUMP VALVE NOT OPERATING CORRECTLY. TIMING IS ADVANCED 10 DEG. IDLE CO TOO RICH. MECHANIC INDICATES PROBLEM WITH COMPUTER SYSTEM, WILL NOT DO THIRD SEQUENCE. FORD DEALER CHG $136.38 FOR EMISSIONS TEST AND NEW FUEL PUMP.
126	A	2.11	51.09	1.59	IDLE SPEED +200, RICH IDLE CO.
	B	2.06	54.05	.43	OIL ONE QUART LOW. PCV FILTER DIRTY. GULF STN IN VA CHG $20.00 FOR "CLEAN CARB & ADJ TMG". IDLE & FTP EMISSIONS SAME.
127	A	.52	10.96	.31	EGR VALVE STICKING IN OPEN POSITION. IDLE SPEED +600. FAILED CO AT LANE.
	B	.77	17.22	.30	O2 SENSOR MAY BE FAULTY, BUT NO CODES STORED. OWNER GOT UNKNOWN REPAIRS FOR ABOUT $20.
130	A	1.24	11.82	.62	WORN CAP, ROTOR, PLUGS. TIMING +7 DEG. EGR DIAPHRAGM LEAKS. AIR BYPASS VALVE STUCK. PCV VALVE & FILTER DIRTY. NO LANE TICKET. PROBABLY FAILED BOTH HC & CO.
	B	.97	11.96	.57	RPM +160, TIMING -2 DEG. CAR NEEDS THE RESTART IDLE TEST, OTHERWISE HIGH IDLE HC & CO. OWNER GOT MINOR TUNE-UP FOR ABOUT $37.
131	A	.85	14.30	.38	IDLE MIXTURE TOO RICH AT IDLE. CHOKE LIM DEVICE ALTERED. TIMING 8 DEG BELOW SPEC. O2 SENSOR SEEMS TO BE PEGGED LEAN AT IDLE, CAUSING RICH MIXT. OWNER HAD CARB OVERHAULED RECENTLY. FAILED CO AT LANE-4.26%, LIMIT 1.5%.
	B	.34	6.27	.42	OIL LEVEL LOW. SEARS DID AN "ENGINE DIAGNOSIS", BUT UNCLEAR WHAT WAS DONE. NO CHARGE BEC SEARS RECENTLY DID SOME WORK. EMISSIONS LOW NOW. NO CHANGE TO TIMING OR IDLE SPEED.
133	A	1.16	19.92	.73	IDLE RPM +500. TIMING 6 DEG LOW. AIR BYPASS DIVERTER VALVE STUCK. FAILED HC-609 AND CO-6.48% AT LANE, LIMITS 300 & 1.5%
	B	.96	14.65	.75	COOLANT SLIGHTLY RUSTY. OIL IS SLIGHTLY OVERFULL. CARBURETOR HAS GUM DEPOSITS ON THE EXTERIOR EVAPORITIVE FAMILY IS EQ. EMISSIONS ARE STILL VERY HIGH. NO APPARENT CHANGES MADE. AMOCO STN DID "SERVICE CARB & ADJ TO PASS", PLUS OIL CHG, FOR $64.11.
134	A	1.57	38.31	.67	RPM +200. TIMING +3 DEG. RICH IDLE CO. IDLE LIMITER DISABLED. CHOKE VAC DIAPHRAGM LEAKS. PLUGS WORN. FAILED CO AT LANE-4.59%, LIMIT 1.5%.
	B	1.07	19.95	.65	ENGINE IDLE SPEED IS NON-ADJUSTABLE. RPM +100, TIMING +3 DEG. A TUNE-UP PLACE IN DC GAVE "ADJ CARB" & RE-INSP. FOR $31.75.
135	A	.16	1.51	.94	ADDED TWO QUARTS OF OIL. NO BUILD DATE AVAILABLE. CAR FAILED AT LANE HC-146 AND CO-15.0%, BUT ALL EMISSIONS AT LAB VERY LOW.
	B	.38	4.63	.91	DEALER GAVE AN EMISSIONS CHECK AT NO CHARGE. PASSED AT LANE.
139	A	.45	6.19	1.02	MIXTURE IS RICH. FUEL ANALYSIS NOT AVAILABLE. MIXTURE LIMITER ALTERED. IDLE SPEE +300, TIMING +5 DEG. FAILED AT LANE HC-409 AND CO-12.3%.
	B	.27	2.87	1.03	IGNITION TIMING IS 7 DEG RETARD. IDLE SPEED IS +240. OWNER WENT TO DLR TWICE BEFORE PASSING AT LANE. GOT CARB OVERHAUL & MISC TUNE-UP WORK FOR $200.

VEH#	TEST SEQ.	FTP RESULTS (g/mi) HC	CO	NOX	COMMENTS
144	A	.37	10.87	.42	NO APPARENT PROBLEMS. ALL SHORT TEST EMISSIONS LOW. FAILED CO AT LANE - 4.29%.
	B	.37	9.08	.44	CARBURETOR VENTURI HAS DIRT ON WALLS. IDLE ADJUSTMENT LIMITING DEVICE BROKEN, (PLUG REMOVED). IGNITION TIMING IS 2 DEG LOW. PLUMBTESMO SHOWS VERY SLIGHT AMT OF PINK. CHEV DEALER CHECKED EMISSIONS, LOW, NO CHG & NO REPAIRS.
	C	.34	8.69	.45	IDLE MIXTURE SCREW TURNED IN TO BRING MIXTURE SOLENOID DWELL TO 30 DEG. PULSE AIR SYSTEM NOT WORKING PROPERLY.
145	A	.29	5.52	.71	CARB VERY DIRTY, PLUGS WORN. ALL SHORT TESTS LOW. FAILED AT LANE HC-470.
	B	.30	4.57	.90	IDLE SPEED IS SLIGHTLY HIGHER THAN SPECIFIED, (+70). OWNER REPORTED PAYING $150 FOR TUNE-UP.
146	A	.54	4.75	.36	ALTERNATOR BELT WORN. IDLE SPEED +125. NO FUEL LEAD ANALYSIS AVAILABLE. IDLE CO RICH DURING UNDER-HOOD INSP, BUT LOW ON SHORT TESTS. FAILED LANE, CO-5.23%.
	B	.36	4.50	.41	ENGINE CURB IDLE SPEED +150. GULF STN DID "LOW EMISSION TUNE", PLUS SCOPE, CLEAN CARB FOR $128.
156	A	.45	3.37	.43	IDLE MIXTURE LIMITING DEVICE PLUG HAS BEEN PUNCHED OUT. SPARK PLUGS SOOTY. PCV FILTER DIRTY. OIL 1/2 QUART LOW. DUMPS AIR TO ATMOSPHERE AT PROLONGED IDLE. FAILED HC-576 PPM & CO-4.42% AT LANE.
	B	.43	3.69	.77	FAST IDLE SPEED LOWER THAN SPEC. IDLE SPEED +250. TIMING IS 8 DEG RETARDED. TIRE STORE ADJ CARB & REINSP FOR $35.51.
157	A	1.47	25.14	.40	IDLE MIXTURE SCREW PLUGS MISSING. SECONDARY VACUUM BREAK DEFECTIVE. EVAPORATIVE CANISTER FILTER MISSING. RICH OXYGEN SENSOR INDICATION (CODE 45). FAST IDLE SPEED LOWER THAN SPEC. IGNITION TIMING -8 DEG. FAILED AT LANE HC-326 AND CO-4.29%.
	B	1.58	32.29	.48	TIMING UNCHANGED. AMOCO STN GAVE ADJ FOR 36.00. VEHICLE THEN PASSED AT S.W. STN.
	C	1.85	32.20	.49	SET CARB MIXTURE SOLENOID DWELL TO 30 DEG, USING AIR BLEED SCREW. NEW CARB WOULD COST $415 AND TAKE 1 WEEK TO GET. SO SENT CAR HOME. WITHOUT 4TH SEQUENCE.
158	A	.28	4.29	.95	IDLE SPEED +500. ALL SHORT TESTS LOW. FAILED AT LANE HC-404 AND CO-1.56%.
	B	.28	4.00	1.02	NO FAST IDLE SPECIFICATION GIVEN. IDLE SPEED IS +350. ALL ELSE APPEARS THE SAME. OWNER SAID HIS BROTHER MADE ADJ, THEN CAR PASSED AT LANE.
159	A	.50	6.07	1.20	SPARK PLUGS HAVE RICH MIXTURE SOOTY DEPOSITS. HIGH CO, ONLY AFTER PROLONGED IDLE. FAILED CO AT LANE - 2.46%.
	B	.75	13.51	1.00	ENGINE OIL 1 QUART LOW. COOLANT LEVEL LOW. DELAY OF VACUUM TO DUMP VALVE APPEARS TO BE TOO SHORT, BUT SOURCE OF PROBLEM CANNOT BE PINPOINTED. TIRE DLR GAVE UNKNOWN REPAIRS FOR $168. PASSED AT LANE, ALTHOUGH EMISSIONS ARE HIGHER THAN BEFORE.
	C	.44	7.96	.93	REPLACED DELAY VALVE TO AIR DUMP SYSTEM.
161	A	2.48	46.38	1.12	TIMING -4 DEG. FAILED CO AT LANE - 6.29%.
	B	.64	15.98	1.94	OXYGEN SENSOR BAD. OWNER TOOK CAR TO A GULF STN FOR MINOR INEFFECTIVE REPAIR, THEN TO FORD DLR FOR AND UNKNOWN 3-WAY PART REPL FOR TOTAL $139.16. DLR TOLD OWNER TO USE RESTART PROCEDURE, WHICH WORKED AFTER 3RD TRY.
	C	.62	14.63	1.77	NEW OXYGEN SENSOR INSTALLED.
162	A	.51	7.25	.67	CAR IS OK. PULSE AIR SYSTEM MAY BE INADEQUATE. NO BUILD DATE AVAILABLE. FAILED LANE HC - 321 & CO - 2.24%.
	B	.57	5.94	.64	CHOKE IS NOT ADJUSTED CORRECTLY. ALTERNATOR BELT IS LOOSE. IDLE SPEED +230. VA DLR GAVE MAJOR TUNE FOR ABOUT $105.

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VEH#	TEST SEQ.	FTP RESULTS (g/mi) HC	CO	NOX	COMMENTS
169	A	3.77	11.31	2.45	ENGINE IDLE SPEED IS AUTOMATICALLY CONTROLLED. IDLE MIXTURE PLUGS BROKEN OUT. SECONDARY VACUUM BREAK DEFECTIVE. CHARCOAL CANISTER FILTER MISSING. OIL IS SLIGHTLY GAS DILUTED AND VERY DIRTY. INITIAL TIMING IS 2 DEG LOW. PLUMBTESMO SLT POS; FAILED HC AT LANE - 1787 PPM.
	B	2.41	17.36	3.55	AIR FILTER IS DIRTY. ENGINE INITIAL TIMING IS 3 DEG LOW. PLUMBTESMO SLIGHTLY POSITIVE. EXXON STN DID CARB OVERHAUL AND COMPLETE TUNE-UP FOR EST $400. COST UNCLEAR DUE TO OTHER MAJOR WORK.
	C	2.13	16.35	4.34	REPLACED AIR FILTER. REPLACED MISSING EVAPORATIVE CANISTER FILTER. CHANGED OIL & FILTER. CHANGED RADIATOR COOLANT. SET INITIAL TIMING TO 15 DEG BTDC. CHECKED SOLENOID DWELL 30 DEG.
171	A	4.58	30.70	.27	TEMPERATURE SENSOR FOR AIR DOOR DEFECTIVE. PCV VALVE BROKE WHEN INSPECTING. FUEL TANK PURGE SOLENOID DEFECTIVE. AIR INJECTION TUBES HAVE HOLES. IDLE SPEED +100. DIVERTER VALVE DEFECTIVE. FAILED CO AT LANE - 5.5%.
	B	.55	9.88	.21	COMBINATION AIR TUBE & CRANKCASE VENT TUBE GROMMET LEAKING OIL EXCESSIVELY. CANISTER PURGE SOLENOID LEAKS VACUUM. SEARS DID UNKNOWN REPAIRS FOR $180. CHEV DLR REPL PULSE AIR UNDER WARRANTY, ALSO SET CARB MIXTURE AND GAVE REINSP FOR $62.90.
172	A	1.11	17.34	.33	AIR CLEANER TEMPERATURE SENSOR DEFECTIVE. PLUMBTESMO SLT POS. FAILED AT LANE, HC - 353 & CO - 7.12%.
	B	1.13	16.95	.33	GULF STN GAVE REINSP & PASS FOR $12.00. NO REPAIRS. IDLE CO ON LAB TESTS SHOWED IT STILL SHOULD FAIL.
	C	.72	8.73	.32	REMOVED AND REPLACED CARBURETOR. ADJUSTED IDLE SPEED TO MANUFACTURERS SPECIFICATIONS @700 RPM IN DRIVE.
175	A	.68	7.14	1.42	METAL HOSE FROM CHECK VALVE TO ENGINE HAS A HOLE IN IT. PCV FILTER IS EXCEPTIONALLY DIRTY. EVAPORATIVE CANISTER FILTER MISSING. OIL LEVEL IS EXCESSIVELY LOW. FAST IDLE SPEED IS GREATER THAN SPECIFIED. IDLE CO TOO RICH. FAILED AT LANE, HC - 314 & CO - 6.06 %.
	B	.48	5.91	1.08	SPARK PLUGS ARE WORN. FAST IDLE SPEED LOWER THAN SPEC. INITIAL TIMING IS 2 DEG RETARDED. OLDS DLR IN MD DID INTERNAL CARB ADJ & MINOR SERVICE FOR ABOUT $133.
177	A	2.66	60.15	.48	IDLE MIXTURE PLUGS BROKEN OUT. EVAP CANISTER FILTER MISSING. FAST IDLE SPEED GREATER THAN SPEC. TIMING -2 DEG. FAILED CO AT LANE.
	B	.33	3.55	2.79	IDLE MIXTURE LIMITING DEVICE PUNCHED OUT. ENGINE SPEED SENSOR DEFECTIVE. VEHICLE SPEED SENSOR CIRCUIT MALFUNCTION. EGR SYSTEM DOUBLE-CHECKED AND IS OK. NO THIRD SEQUENCE GIVEN. OLDS DLR REPL CHK VLV AND INTAKE MAIN PIPE FOR AIR SYSTEM, AND REPL ECM, ALL UNDER WARRANTY.
179	A	3.02	88.05	.11	INITIAL TIMING IS UNREADABLE-NO MARKS GIVEN. CURB IDLE SPEED IS HIGHER THAN SPEC. IDLE CO EXCESSIVELY HIGH. LANE ICO=10.51.
	B	2.03	44.13	.25	NO OBVIOUS PROBLEMS WERE FOUND. NO THIRD SEQUENCE WILL BE PERFORMED SINCE WE DON'T HAVE THE PROPER EQUIPMENT FOR THIS TYPE OF VEHICLE. NO CHARGE, PASSED AT LANE. ADJUSTED FUEL INJECTION SYSTEM.
182	A	1.45	76.04	.73	PCV VALVE IS BROKEN. CODE 55 STORED, MAY BE AN ERROR. FAST IDLE SPEED LOWER THAN SPEC. EGR VALVE INOPERATIVE. CURB IDLE SPEED +100.
	B	.40	6.50	2.57	EGR VALVE FROZEN. STILL SHOWS CODE 55. OWNER GOT A TUNE-UP FOR $39.95.
	C	.32	1.55	1.24	INSTALLED NEW EGR VALVE AND SET IDLE SPEEDS.

VEH#	TEST SEQ.	FTP RESULTS (g/mi) HC	CO	NOX	COMMENTS
192	A	.69	3.76	.51	AIR CLEANER TEMP SENSOR DEFECT. AIR FILT CLOGGED W/DIRT. SPK PLUGS WORN. BOTH CANISTER PURGE SLNDS DEFECTIVE. EXTERNAL OIL LKAGE. SPK PLG WIRES DFCTV. FAST IDLE SPD LOWER THAN SPEC. PULSE AIR VACUUM VLV IS INOPERATIVE. INIT TIMG IS 6 DEG RETARD. IDLE SPD IS +200. PLUMB SLT POS. LANE CO - 4.93%.
	B	.38	3.82	.64	AIR INJECTION TUBES RUSTED AND LEAKING. CANISTER PURGE SOLENOID LEAKS VACUUM. TEMPERATURE SENSOR FOR HEAT DOOR INOPERATIVE. INITIAL TIMING 7 DEG LOW. IDLE SPEED +450. CHEV DLR IN DC DID CARB WORK & MISC FOR ABOUT $250.
199	A	1.59	25.81	1.21	PLUG APPEARS FOULED. PCV VALVE AND FILTER IS VERY DIRTY. FAST IDLE SPEED HIGHER THAN SPEC. EXHAUST SYSTEM LEAKS. FAILED CO AT LANE- 3.03%.
	B	1.09	18.51	1.25	IDLE MIXTURE PLUG MISSING. IDLE CO HIGH ONCE DURING LAB INSP, VERY LOW DURING SHORT TESTS. TIRE DLR REPL AIR FLTR AND GAVE REINSP FOR $32.73.
	C	.80	14.32	1.12	LAB ADJUSTED IDLE MIXTURE AND CURB IDLE SPEED.
204	A	1.41	10.52	3.75	IDLE MIXTURE IS TOO RICH. FAILED CO AT LANE: 3.39%.
	B	1.45	7.58	3.59	TIMING +6 DEG. VOLVO DLR ADJ LAMBDA DUTY CYCLE FOR $21.08.
211	A	1.95	50.35	.65	AIR FILTER EXCESSIVELY DIRTY. SPARK PLUGS WORN. VACUUM ADVANCE ASSEMBLY DIAPHRAGM LEAKS. NO ENGINE SPECIFICATIONS AVAILABLE. ENGINE DECAL MISSING. FAILED CO AT LANE - 3.94%.
	B	2.09	49.00	.77	OWNER PAID ABOUT $75 FOR A MINOR TUNE-UP AND RE-INSPECTION FEE. NO 3RD SEQUENCE WAS DONE BECAUSE OWNER COULD NOT WAIT ANY LONGER.
213	A	1.07	13.72	1.24	IGNITION TIMING UNREADABLE. IDLE CO AND HC HIGH. FAILED CO AT LANE - 7.01%.
	B	.76	3.27	1.05	COLD START VALVE DEFECTIVE. VACUUM ADVANCE DIAPHRAGM LEAKS. A FRIEND AT BMW DEALERSHIP ADJ AIR FLOW METER AT NO CHG.
221	A	4.09	56.22	1.11	AIR CLEANER VACUUM HOSE IS NOT FITTING CORRECTLY. FAST IDLE SPEED LOW. IDLE SPEED IS +350. TIMING IS +8 DEG. FAILED AT LANE HC:733 AND CO:4.68%.
	B	1.34	24.73	2.52	HOSE FROM EGR TVS CROSSED WITH HOSE FROM SWITCHING VALVE TVS. AC NOT WORKING, HOSE LEAKING, AC SOLENOID NOT WORKING. IDLE SPEED +500. DLR GAVE MINOR TUNE FOR $66.25.
	C	1.63	33.79	1.26	CHANGE HOSE AT EGR TVS WITH HOSE FROM SWITCHING VALVE.
223	A	.28	5.57	.85	IDLE SPEED +100, EGR DIAPHRAGM APPEARS TO LEAK. FAILED HC: 312 AND CO: 2.16% AT LANE.
	B	.23	4.83	.98	GAS STN GAVE RE-INSP FOR $10.60. NO REPAIRS MADE.
228	A	1.20	21.63	1.11	IGNITION TIMING MARKS NOT VISIBLE, HIGH CO EMISSIONS. DURING UNDERHOOD INSP ONLY. FAILED CO AT LANE: 5.89%.
	B	1.14	20.54	1.09	CAR NEEDS PLUGS AND WIRES. PLUG FOR MIXTURE ADJUSTMENT IS MISSING. CAR ADJUSTED BY A FRIEND, WHO OWNS A SERVICE STN, AT NO CHG, BUT NO APPARENT CHANGES MADE.
	C	.88	13.40	1.06	SPARK PLUGS AND CABLES REPLACED. MIXTURE SET.
230	A	1.59	26.79	.62	HOSE FROM CCEV CROSSED WITH HOSE FROM AIR CLEANER SENSOR. FAILED AT LANE HC:538 & CO:13.08%.
	B	1.50	26.17	.60	AIR CLEANER TEMPERATURE SENSOR NOT FUNCTIONING. TIMING IS -2 DEG. OWNER PAID $35.22 AT A SERV STN FOR "SET TO SPECS".
	C	.84	15.19	.79	ADJUST IDLE MIXTURE.

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VEH#	TEST SEQ.	FTP RESULTS (g/mi) HC	CO	NOX	COMMENTS
231	A	1.00	13.46	1.64	OIL LEVEL IS ONE QUART LOW. INITIAL TIMING MARK NOT FOUND. FAILED AT LANE HC:936 AND CO:12.19%. EPA EST MILEAGE OF THIS VEH FROM OWNERS STATEMENTS.
	B	8.32	181.07	.32	FUEL INJECTION COMPONENTS MAY BE DEFECTIVE. INITIAL TIMING IS -14 DEG FROM SPEC. IDLE SPEED IS 100 RPM. GAS STN ADJ FUEL INJECTION FOR $19.08.
	C	.56	4.83	.87	OXYGEN SENSOR REPLACED & IDLE MIXTURE ADJUSTED. TIMING STILL -14 DEG.
234	A	.40	6.31	.45	PULSE AIR TUBES RUSTED THROUGH. TIMING +7 DEG, IDLE SPEED +100. FAILED HC-314 AND CO-5.93% AT LANE.
	B	.36	4.88	.47	PULSE AIR TUBES RUSTED THROUGH. SPENT $49.43 FOR TUNE-UP AT AN AUTO SERVICE CENTER.
245	A	3.75	55.91	3.34	BUILD DATE NOT AVALIABLE. CARBURETOR ASSEMBLY IS EXCEPTIONALLY DIRTY. CANISTER FILTER IS MISSING. IDLE SPEED IS AUTOMATICALLY CONTROLLED. FAST IDLE SPEED LOWER THAN SPECIFIED. EGR VALVE DOES NOT WORK. INITIAL TIMING IS -13 DEG. FAILED CO AT LANE: 8.12%.
	B	.98	11.56	2.88	TIMING IS -3 DEG NOW. 2 REPAIRS AND RETESTS BEFORE PASSING. BUICK DLR FIRST DID A MIXT ADJ, THAN ANOTHER ONE & A NEW DIST CAP, FOR $67.00 TOTAL.
	C	1.04	10.81	.93	REPLACED EGR VALVE.
257	A	.46	4.62	.65	HOSE FROM CARBURETOR TO PURGE CONTROL SOLENOID OFF. IDLE RPM 100 LOW. FAILED CO AT LANE: 2.55%.
	B	.20	2.53	.78	OWNER PAID $119.36 FOR CARB WORK, AND RE-INSP AT A GAS STN.
258	A	2.41	59.62	1.89	AIR FILTER IS EXCEPTIONALLY DIRTY. PCV VALVE EXCEPTIONALLY DIRTY. TIMING MARKS UNREADABLE. IDLE CO AND HC TOO RICH. FAILED AT LANE HC:450 AND CO:12.27%.
	B	2.14	51.67	2.08	DIVERTOR VALVE CONSTANTLY DUMPS. EGR VALVE STUCK CLOSED. GAS STN "SET EMISSION CONTROL FOR INSP" FOR $36.69, INCL RE-INSP FEE.
	C	1.28	28.28	.81	REPLACED EGR VALVE.
266	A	.43	7.10	2.04	DISTRIBUTOR ROTOR & CAP WORN. DIVERTER VALVE DUMPS CONSTANTLY, VACUUM PROBLEM. EGR VALVE DIAPHRAGM LEAKS. OIL LEVEL IS EXCESSIVELY LOW. OIL IS VERY DIRTY. CLNT IS VERY LOW. CLNT IS VERY RUSTY. INIT TIMING IS RETARD 6 DEG FROM SPEC. IDLE SPEED HIGHER THAN SPEC. IDLE CO AND HC TOO RICH. LANE HC - 293, CO - 11.98.
	B	.48	8.69	1.21	DIVERTER DUMPS CONTINUOSLY, ELECTRONICS. EGR VALVE DIAPHRAGM LEAKS. TIMING IS RETARDED. SERVICE STATION REPLACED AIR FILTER. PCV VALVE & VENT FILTER, FUEL & OIL FILTERS, DID NOT PASS. SECOND SERVICE STATION PASSED CAR. $44.58 FOR PARTS & LABOR AT FIRST STN. INSP FEE ONLY AT 2ND STN.
	C	.65	6.91	.67	TIMING CORRECTED. AIR PUMP STILL DUMPS TOO MUCH. NEW EGR VALVE INSTALLED.
268	A	1.92	46.15	.55	CARBURETOR ASSEMBLY IS EXCEPTIONALLY DIRTY. PCV FILTER IS EXCEPTIONALLY DIRTY. ENGINE OIL IS EXCEPTIONALLY DIRTY. ENGINE OIL IS VERY LOW. HEATED AIR DUCT MISSING. IDLE MIXTURE LIMITING DEVICE IS MISSING. CURB IDLE SPEED IS -80. FAILED CO AT LANE: 4.8%.
	B	2.42	74.81	.35	CHOKE STAYS ON DUE TO POOR ELECTRICAL CONNECTION. OWNER BOUGHT MINOR PARTS FOR $9.93 AND PASSED RE-INSP. UNCLEAR IF ANY REPAIRS OR ADJ WERE MADE.
	C	1.08	32.26	.62	ELECTRIC CHOKE CONNECTION CLEANED.
270	A	1.50	20.94	1.58	TEMPERATURE SENSOR NOT WORKING. SPARK PLUGS WORN. OIL LEVEL IS TWO QUARTS LOW. INITIAL TIMING IS -2 DEG. IDLE SPEED IS -260. IDLE CO RICH AT UNDERHOOD INSP, BUT LOW ON SHORT TESTS. FAILED CO AT LANE: 5.34%.
	B	1.11	15.12	1.46	OWNER HAD MINOR MAINT PERFORMED, BUT ALL WAS UNRELATED TO THE EMISSIONS FAILURE, FOR $37. PASSED RE-INSP AT LANE.
	C	.90	11.81	1.44	IDLE MIXTURE AND IDLE SPEED SET TO SPEC.

VEH#	TEST SEQ.	FTP RESULTS (g/mi) HC	CO	NOX	COMMENTS
272	A	7.11	152.36	2.74	CODE 45 SHOWING RICH OXYGEN SENSOR. HOSE TO SPEED CONTROL OFF, HOSE CONNECTED WRONG. EGR VALVE DIAPHRAGM LEAKS. LANE IHC=347, ICO=3.54.
	B	7.22	150.27	2.81	CURB IDLE SPEED IS ELECTRONICALLY CONTROLLED. AIR CLEANER TEMPERATURE SENSORS ARE INOPERATIVE. SPARK PLUGS ARE WORN. RICH OXYGEN SENSOR INDICATION, CODE 45. EGR VALVE DEFECTIVE. REPAIR SHOP REPLACED CRANKCASE FILTER. $15.00 FOR EMISS TEST. $12.53 FOR FILT.
	C	7.57	152.74	1.97	REPLACED EGR VALVE, SPARK PLUGS, AIR CLEANER PVS SWITCH, AND HOT AIR DOOR TEMPERATURE SENSOR.
274	A	5.39	207.52	.19	VACUUM ADVANCE ASSEMBLY LEAKS VACUUM. HEATED AIR DUCT DAMAGED. COLD START INJECTOR UNPLUGGED. IDLE CO IS TOO RICH. TIMING MARKS NOT PRESENT. IDLE SPEED IS + OR - 75 RPM. LANE IHC=305, ICO=13.78.
	B	.98	8.12	.36	HOLE IN TAILPIPE. NO SPECS AVAILABLE FOR TIMING. WHEN MEASURED, TIMING WAS ON THE "1" MARK. DEALER REPLACED OXYGEN SENSOR ($75.08) TOTAL COST $131.16 INCLUDING IDLE SPEED ADJUSTMENT & CLEANING INJECTORS.

Appendix C: Results of Federal Test Procedures

VEHICLE NUMBER	SCORES FROM FIRST FTP HC (g/mi)	CO (g/mi)	NOx (g/mi)	MPG	SCORES FROM SECOND FTP HC (g/mi)	CO (g/mi)	NOX (g/mi)	MPG	SCORES FROM THIRD FTP HC (g/mi)	CO (g/mi)	NOx (g/mi)	MPG
2	4.03	55.76	1.23	17.46	2.74	45.82	1.24	16.14	-	-	-	-
4	2.04	44.61	1.00	19.66	2.74	69.38	.84	19.25	-	-	-	-
5	1.51	23.63	1.09	23.64	.79	9.37	1.40	22.42	-	-	-	-
8	1.36	23.10	.59	26.72	.73	13.13	.47	24.68	-	-	-	-
14	3.07	62.33	1.07	23.29	2.29	50.21	1.61	26.25	-	-	-	-
17	2.24	23.49	2.54	15.99	3.07	34.20	2.28	15.00	-	-	-	-
19	.43	4.39	2.50	26.13	.44	4.87	2.16	26.05	-	-	-	-
20	.57	8.80	.77	35.90	.42	4.31	1.02	28.85	-	-	-	-
21	1.41	9.71	2.31	19.26	1.53	9.50	1.81	19.53	-	-	-	-
24	.11	1.09	2.13	25.23	.10	.99	2.04	25.15	-	-	-	-
26	.15	9.99	1.52	21.87	.17	5.52	1.58	22.77	-	-	-	-
28	.30	3.71	1.47	29.05	.33	3.70	1.66	28.58	-	-	-	-
29	.65	12.17	1.82	27.58	.28	2.50	1.96	27.92	-	-	-	-
39	.74	2.64	3.31	16.26	.63	3.76	3.26	14.97	-	-	-	-
40	1.12	9.34	1.26	17.49	1.26	12.02	1.81	18.21	-	-	-	-
41	1.69	34.82	1.41	17.38	.91	6.23	1.67	18.37	-	-	-	-
42	2.19	36.13	3.17	16.33	3.06	51.31	3.04	15.80	-	-	-	-
43	2.41	57.89	1.43	16.80	1.32	11.55	4.97	17.95	.52	3.05	1.85	17.88
46	1.39	22.03	3.28	19.94	1.30	16.87	3.11	19.91	1.09	7.38	2.11	20.12
47	3.23	82.40	1.13	11.55	.55	9.09	1.56	13.29	-	-	-	-
48	.94	2.29	2.70	18.62	.64	2.69	1.60	17.10	-	-	-	-
49	2.03	33.30	1.92	15.09	1.57	22.68	1.80	15.49	-	-	-	-
51	3.38	75.00	3.22	19.97	1.93	50.33	3.04	20.85	1.57	51.88	2.38	20.49
52	1.06	23.16	2.70	19.52	1.20	28.75	2.69	19.75	-	-	-	-
102	2.22	27.48	1.31	15.62	1.49	18.97	.69	14.81	-	-	-	-
103	1.48	14.00	1.58	15.32	2.88	93.86	1.38	12.59	-	-	-	-
104	.38	5.19	2.78	18.37	.27	3.25	2.54	19.06	.25	3.12	1.47	17.86
105	1.16	14.42	1.19	21.96	.97	13.14	1.19	21.78	-	-	-	-
108	.39	6.70	.35	26.27	.34	5.60	.34	23.98	-	-	-	-
109	10.30	179.85	.73	12.16	1.80	10.93	2.21	15.65	-	-	-	-
111	.31	5.11	1.60	18.57	.29	2.13	1.47	19.32	-	-	-	-
115	.53	19.87	1.32	22.10	.49	18.76	1.53	21.74	-	-	-	-
120	.46	8.60	1.61	30.49	.48	8.29	1.81	30.94	-	-	-	-
121	.22	2.76	.81	31.04	.26	3.19	.77	29.52	-	-	-	-
124	3.68	27.44	2.67	15.83	2.94	28.11	1.92	17.51	-	-	-	-
126	2.11	51.09	1.59	22.64	2.06	54.05	.43	21.94	-	-	-	-
127	.52	10.96	.31	24.01	.77	17.22	.30	24.64	-	-	-	-
130	1.24	11.82	.62	14.89	.97	11.96	.57	14.46	-	-	-	-
131	.85	14.30	.38	25.26	.34	6.27	.42	25.71	-	-	-	-
133	1.16	19.92	.73	15.45	.96	14.65	.75	15.06	-	-	-	-
134	1.57	38.31	.67	17.26	1.07	19.95	.65	17.80	-	-	-	-
135	.16	1.51	.94	24.88	.38	4.63	.91	24.36	-	-	-	-
139	.45	6.19	1.02	28.25	.27	2.87	1.03	29.80	-	-	-	-
144	.37	10.87	.42	26.91	.37	9.08	.44	26.78	.34	8.69	.45	26.69
145	.29	5.52	.71	27.06	.30	4.57	.90	27.95	-	-	-	-
146	.54	4.75	.36	29.83	.36	4.50	.41	28.46	-	-	-	-
156	.45	3.37	.43	17.37	.43	3.69	.77	17.76	-	-	-	-
157	1.47	25.14	.40	18.49	1.58	32.29	.48	18.39	1.85	32.20	.49	18.96
158	.28	4.29	.95	28.18	.28	4.00	1.02	28.09	-	-	-	-
159	.50	6.07	1.20	21.49	.75	13.51	1.00	19.15	.44	7.96	.93	19.25
161	2.48	46.38	1.12	15.52	.64	15.98	1.94	15.24	.62	14.63	1.77	15.26

VEHICLE NUMBER	SCORES FROM FIRST FTP HC (g/mi)	CO (g/mi)	NOx (g/mi)	MPG	SCORES FROM SECOND FTP HC (g/mi)	CO (g/mi)	NOX (g/mi)	MPG	SCORES FROM THIRD FTP HC (g/mi)	CO (g/mi)	NOx (g/mi)	MPG
162	.51	7.25	.67	26.73	.57	5.94	.64	27.24	-	-	-	-
169	3.77	11.31	2.45	19.20	2.41	17.36	3.55	17.59	2.13	16.35	4.34	18.10
171	4.58	30.70	.27	23.41	.55	9.88	.21	25.50	-	-	-	-
172	1.11	17.34	.33	26.41	1.13	16.95	.33	25.86	.72	8.73	.32	27.41
175	.68	7.14	1.42	20.05	.48	5.91	1.08	19.79	-	-	-	-
177	2.66	60.15	.48	16.38	.33	3.55	2.79	18.43	-	-	-	-
179	3.02	88.05	.11	19.84	2.03	44.13	.25	21.39	-	-	-	-
182	1.45	76.04	.73	15.21	.40	6.50	2.57	18.00	.32	1.55	1.24	17.45
192	.69	3.76	.51	27.10	.38	3.82	.64	25.95	-	-	-	-
199	1.59	25.81	1.21	20.61	1.09	18.51	1.25	21.09	.80	14.32	1.12	22.02
204	1.41	10.52	3.75	21.56	1.45	7.58	3.59	21.56	-	-	-	-
211	1.95	50.35	.65	26.03	2.09	49.00	.77	26.30	-	-	-	-
213	1.07	13.72	1.24	23.79	.76	3.27	1.05	24.09	-	-	-	-
221	4.09	56.22	1.11	17.59	1.34	24.73	2.52	21.34	1.63	33.79	1.26	20.85
223	.28	5.57	.85	26.50	.23	4.83	.98	25.56	-	-	-	-
228	1.20	21.63	1.11	21.45	1.14	20.54	1.09	21.37	.88	13.40	1.06	19.66
230	1.59	26.79	.62	15.01	1.50	26.17	.60	14.93	.84	15.19	.79	16.39
231	1.00	13.46	1.64	20.52	8.32	181.07	.32	14.93	.56	4.83	.87	20.97
234	.40	6.31	.45	28.73	.36	4.88	.47	27.76	-	-	-	-
245	3.75	55.91	3.34	16.40	.98	11.56	2.88	19.38	1.04	10.81	.93	19.24
257	.46	4.62	.65	26.80	.20	2.53	.78	26.89	-	-	-	-
258	2.41	59.62	1.89	13.32	2.14	51.67	2.08	13.77	1.28	28.28	.81	13.50
266	.43	7.10	2.04	13.52	.48	8.69	1.21	12.39	.65	6.91	.67	13.22
268	1.92	46.15	.55	21.72	2.42	74.81	.35	17.97	1.08	32.26	.62	22.07
270	1.50	20.94	1.58	20.88	1.11	15.12	1.46	21.59	.90	11.81	1.44	21.43
272	7.11	152.36	2.74	11.42	7.22	150.27	2.81	11.45	7.57	152.74	1.97	11.52
274	5.39	207.52	.19	15.28	.98	8.12	.36	22.13	-	-	-	-

Appendix D: Results of Idle-Neutral Modes of Short Tests during the First Test Sequence

VEHICLE NUMBER	FOUR-MODE IDLE FIRST MODE HC (ppm)	FIRST MODE CO (%)	THIRD MODE HC (ppm)	THIRD MODE CO (%)	LOADED TWO-MODE IDLE MODE HC (ppm)	IDLE MODE CO (%)	RESTART IDLE HC (ppm)	RESTART IDLE CO (%)
2	510	6.80	700	7.40	700	7.40	700	7.40
4	250	1.50	250	2.00	350	1.80	240	1.90
5	75	1.80	105	3.10	130	3.60	75	2.10
8	80	3.30	65	2.60	50	2.10	55	1.60
14	240	2.40	240	2.60	260	2.85	220	2.40
17	40	.02	40	.02	50	.02	40	.02
19	120	1.30	80	1.20	20	.02	100	1.20
20	40	.90	50	.60	60	.70	50	.60
21	300	1.10	310	1.30	300	1.40	320	1.20
24	20	.02	20	.02	20	.02	20	.02
26	20	.70	20	.40	20	.03	20	.02
28	40	.05	40	.07	40	.05	40	.05
29	400	6.00	390	5.60	390	5.80	370	5.40
39	300	.04	130	.04	230	.04	125	.04
40	90	.05	100	.05	70	.04	65	.05
41	230	3.00	215	2.90	205	3.00	215	3.00
42	490	5.40	510	6.10	340	3.70	350	4.00
43	250	5.40	230	5.20	220	5.00	230	4.90
46	100	.50	100	1.00	100	1.00	100	.80
47	320	5.30	330	5.40	275	4.60	305	5.00
48	190	.02	160	.02	220	.02	150	.02
49	375	5.40	350	5.20	370	5.40	360	5.40
51	220	4.00	190	4.00	200	4.10	190	4.00
52	50	1.35	60	1.10	40	1.10	45	.40
102	800	6.80	600	5.00	800	6.00	650	4.50
103	50	.15	50	.15	60	.19	50	.12
104	180	2.80	160	2.60	170	3.00	170	2.80
105	22	.25	21	.40	43	.20	21	.20
108	37	.05	23	.04	23	.03	23	.03
109	650	5.20	880	5.40	520	3.00	100	2.20
111	18	.15	25	.22	25	.25	30	.18
115	85	1.20	70	.90	70	1.10	50	.33
120	25	.04	20	.04	25	.03	20	.04
121	20	.02	35	.02	20	.02	60	.02
124	800	2.00	800	2.20	300	.08	800	2.00
126	260	3.10	310	3.50	245	3.60	250	3.20
127	230	2.60	180	3.00	190	3.40	180	3.10
130	220	3.60	210	3.40	40	.05	40	.05
131	200	4.10	190	3.60	190	4.00	190	3.50
133	335	2.60	350	2.60	290	2.10	320	2.40
134	130	3.20	130	3.50	135	3.30	120	3.20
135	40	.05	35	.05	30	.05	30	.04
139	300	3.20	250	2.50	320	3.00	260	2.50
144	70	.15	35	.06	25	.04	40	.06
145	35	.04	40	.04	35	.04	40	.04
146	115	.60	70	.09	85	.20	80	.10
156	180	1.50	25	.04	20	.04	20	.04
157	130	1.55	135	1.40	130	1.40	105	1.00
158	40	.05	30	.04	35	.04	35	.04
159	30	.04	20	.04	30	.04	20	.04
161	160	1.10	140	1.25	140	1.30	125	1.20
162	80	.50	80	.65	60	.21	80	.80
169	1000	.11	740	.15	720	.14	850	.16
171	120	2.05	120	1.85	120	2.10	125	1.90
172	145	1.90	150	1.70	145	1.80	150	1.70
175	260	4.40	40	.12	20	.10	25	.09
177	100	1.20	100	1.20	95	1.20	95	1.10
179	130	2.80	140	3.00	140	3.10	140	2.80
182	35	.03	75	.70	60	.25	40	.04
192	50	.15	25	.05	25	.05	30	.05
199	45	.03	65	.04	65	.04	50	.03
204	110	1.35	105	1.20	100	1.20	95	1.20
211	135	1.30	140	1.60	130	1.20	140	1.70
213	90	1.90	85	1.85	85	1.80	85	1.80
221	35	.07	190	.80	370	1.60	60	.35
223	10	.03	10	.03	10	.03	10	.03
228	15	.09	20	.08	20	.07	20	.10
230	20	.40	30	.20	25	.30	40	.50
231	20	.04	15	.03	20	.04	15	.03
234	45	.08	25	.03	15	.03	20	.03
245	900	.21	700	.22	600	.22	480	.19
257	90	.86	80	.48	80	.50	80	.39
258	185	2.80	190	2.90	180	2.80	190	2.70
266	20	.03	95	2.00	20	.02	20	.03
268	20	.31	20	.10	70	.95	20	.25
270	40	.29	40	.20	70	.28	65	.30
272	45	.30	60	.55	90	1.00	140	2.10
274	115	3.80	120	3.60	120	3.60	560	3.50

Appendix E: Results of Idle Neutral Modes of Short Tests of Vehicles which had High Idle Emissions after Commercial Repairs

VEHICLE NUMBER	FOUR-MODE IDLE FIRST MODE HC (ppm)	FIRST MODE CO (%)	THIRD MODE HC (ppm)	THIRD MODE CO (%)	LOADED TWO-MODE IDLE MODE HC (ppm)	IDLE MODE CO (%)	RESTART IDLE HC (ppm)	RESTART IDLE CO (%)
2	350	3.70	325	3.80	325	3.50	300	3.80
4	380	6.10	390	6.80	390	6.60	380	6.40
42	400	5.50	390	6.00	390	5.50	400	6.10
49	290	3.50	280	3.50	290	3.50	285	3.70
126	230	3.50	230	3.30	280	4.00	250	3.20
127	250	2.60	260	3.60	230	3.20	220	3.10
133	450	3.70	480	3.70	400	3.10	450	3.50
231	420	1.20	360	1.20	420	1.20	410	1.20